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Description of the Communication Protocol

for Series 4 LD ... 9LD OEM pressure transmitter from KELLER

Version 2.1

1 Introduction

Visually the Series 4 LD … 9 LD are like standard KELLER pressure transducers with a 5 pin interface to connect the half-open Wheatstone Bridge. But these I^2C versions contain beside the pressure sensor a very tiny signal conditioner. This results in an OEM pressure transmitter with a digital interface. The “D” stands for “digital” and for “dual”; the LD-Line provides pressure and temperature information.

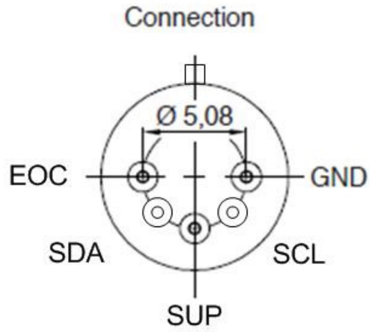
The most important topics regarding the communication with the Series 4 LD … 9 LD and KELLER’s unique embedded DSP core, are listed in this protocol description - especially the interpretation of the readout values.

For more information about the I^2C specification please visit the NXP website and have a look at the User Manual in the documents section. I^2C is a licence free standard since 2006: http://www.nxp.com/documents/user_manual/UM10204.pdf

2 Electrical Interface

2.1 Pinout

Lable	Description	Wire
SUP	1,8...3,6 V	BK
GND	GND	WH
SCL	I^2C Clock	YE
SDA	I^2C Data	BU
EOC	End of Conv.	RD



Notes

Be careful with the glazed pins, cracks in the glass pills causes leakage => damage

Do not touch the steel diaphragm!

Cabling

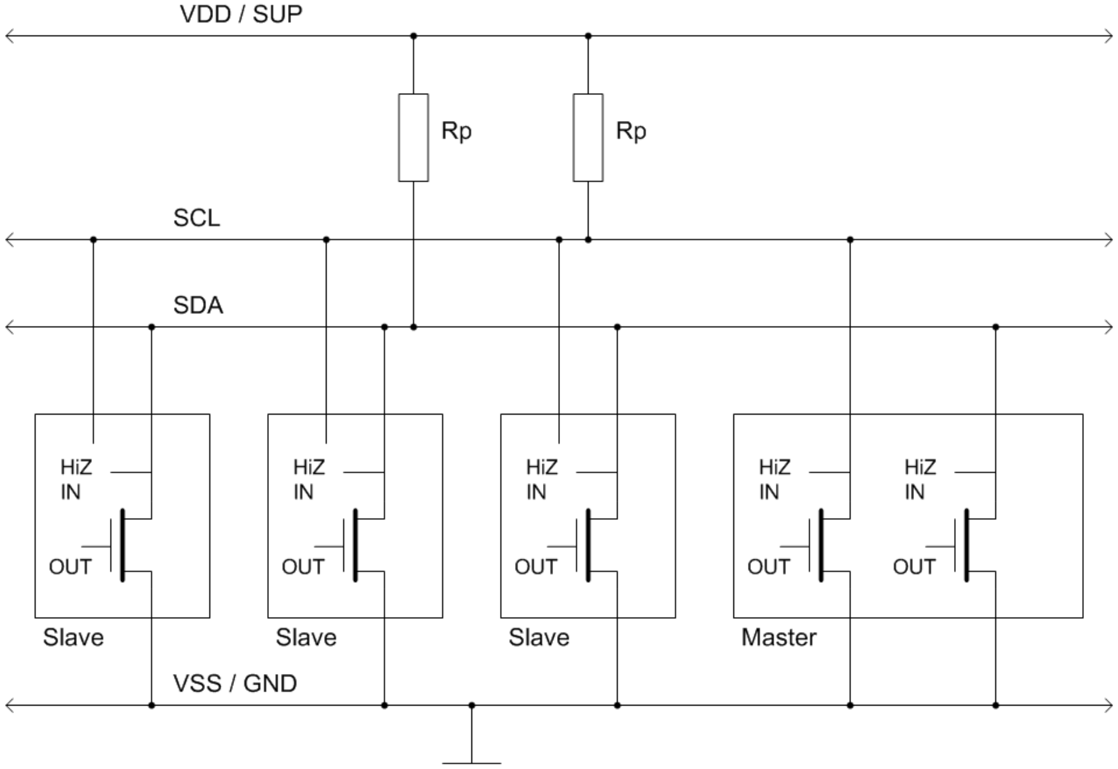
There are no special requirements to the wires or a flexible printed circuit (FPC) depending on the cross section because the current consumption is very low.

Sleep-Mode typ. 100nA

Active-Mode typ. 1.5mA (during conversion in less than 4ms)

Be careful with cabling over more than a few centimetres. The I^2C-Bus is not a fieldbus and only EMC safe if the interconnections are short or screened by the surrounding housing of the whole application or a suitable cable.

2.2 Pull-up Resistors



Pull-up resistors are needed at SDA and SCL. 1..10kOhm are recommended. In order to optimise the data rate or low power consumption, other resistance values are possible.

The EOC-Pin supplies an active high level in idle state and an active low level during conversion.

The SCL and the SDA lines are open drain driven. The wired-AND circuits avoid level collisions. Additional series resistors placed directly at the bus members leads to even more security.

An electric HIGH level stands for '1', a LOW level for '0' => positive Logic

Please be careful with non open drain hardware like general purpose IOs and tri-state tricks.

2.3 Bit Rate

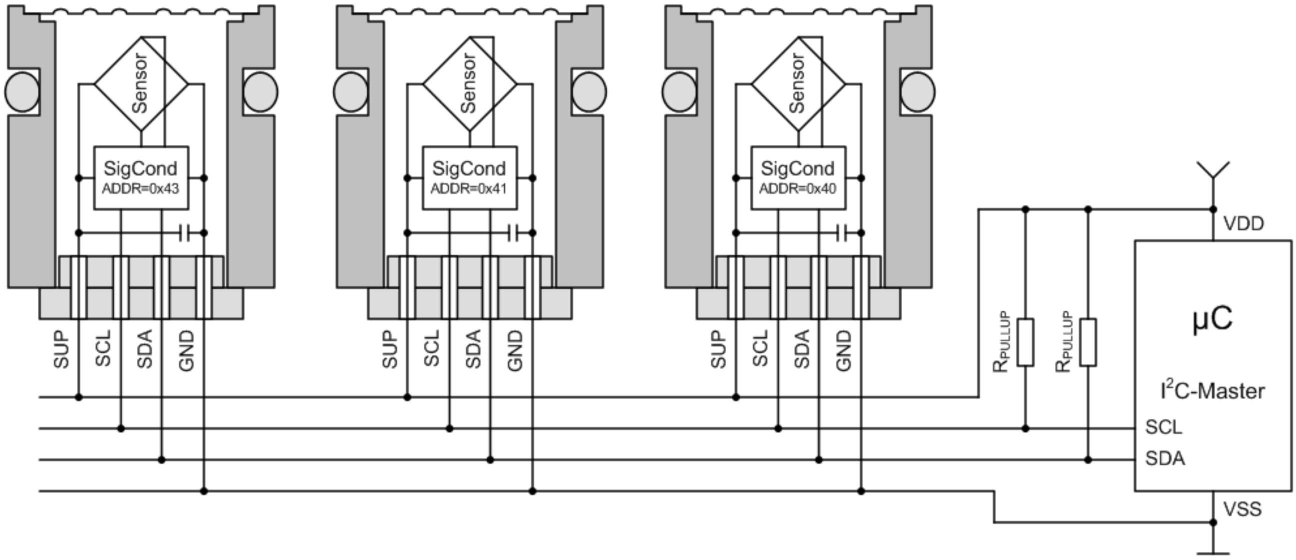
The D-Line transmitters work over a wide range of data transfer speeds. All four modes are supported because the maximum clock frequency is 3.4MHz.

Mode	Max. Bit Rate
Standard Mode	100 kbit/s
Fast Mode	400 kbit/s
Fast Mode Plus	1 Mbit/s
High Speed Mode	3.4 Mbit/s

It is recommended to start with a low speed e.g. 50kHz - get the whole thing working – and than increase the bit rate if needed. The maximal possible speed depends also on the cable length (capacity) and the pull-up resistors.

Because the I²C interface is a synchronous serial bus, the bit rate doesn't have to be stable. The master defines the timing. That makes bit banging easy if there is no dedicated hardware integrated in the master controller.

2.4 Bus Capability



The bus capability is given by the electrical and the protocol bus level.

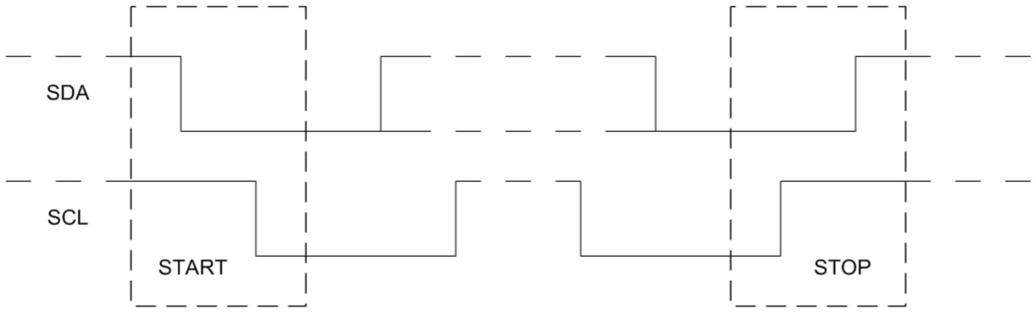
Electrical are only active LOW levels allowed. This avoids short circuit currents caused by a collision of a HIGH and a LOW level and makes clock stretching possible.

On the protocol level addressing is needed. Therefore every slave on the same bus has to respond on a different address. The address is stored in the memory of the transmitter.

The additional EOC lines (undrawn) which signalise the End-Of-Conversion can not be coupled together without an AND gate. But there are solutions without using the EOC line or the EOC lines have to be parallel conducted.[MH1]

3 Data Frame

3.1 START and STOP Condition



Every data frame is bordered by a start and a stop condition.

The START bit (S) is caused by pulling down SDA while SCL stays high. Then SCL has to go low before the first data bit is set. SCL is than ready for a positive edge - when the data line is valid - to trigger the receiver.

After the last transferred data bit the SCL line goes high and the STOP bit (P) is sent by releasing SDA while SCL is constantly high.

3.2 ADDRessing

The first Byte of every data frame contains the slave address and R/W bit.

The 7 bits allow 112 bus nodes. 16 of the 128 possible addresses are reserved (0x00 .. 0x07 and 0x78 .. 0x7F). The default slave address of the D-Line transmitters is:

0x40

D-Line transmitters answer only to the address stored in the memory. There is no response to the general call address 0x00.

Examples

ADDR is 0x43: For a data transfer from the master to the slave (write) the first byte is 0x86.

ADDR is 0x47: For a data transfer from the slave to the master (read) the first byte is 0x8F.

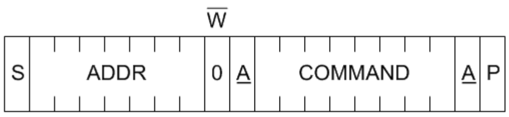
3.3 ACKnowledge

After every transferred byte (in both directions) the receiver of the byte gives feedback with the acknowledge bit.

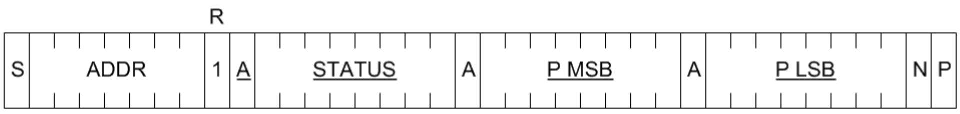
The slave should always confirm the bytes by an ACK (A). If the slave does not respond with a LOW level after the 8th bit, the master detects an exception (for example caused by requesting to the wrong slave address).

A NACK (N) form the master's side is not always an exception. It is also needed to terminate a read data frame.

I²C Write



I²C Read



Underlined bits and bytes come from the slave, the rest comes from the master.

3.4 STATUS Byte

Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Meaning	0	1	Busy?	Mode		Memory error?	Don't care	Don't care

Busy? 0 = conversion completed, 1 = busy

Mode 00 = Normal Mode, 01 = Command Mode, 1X = Reserved

Memory error? 0 = checksum okay, 1 = error

3.5 DATA Bytes

The data registers of the D-line transmitters are always 16 bit long. Before the data bytes stands always a STATUS byte.

Therefore are three possibilities to read out data useful: one, three or five bytes.

By reading one byte you just get the STATUS of the D-Line transmitter.

Reading three bytes is useful to get STATUS and the pressure information [u16] or a 16 bit register from the memory.

Reading two additional bytes (five bytes over all) is useful to get both 16 bit measurement information – pressure and temperature.

The master has to terminate a read data frame with a NACK and the obligatory STOP bit independent from the count of read bytes.

4 Get Measurement Data

Underlined bits and bytes come from the slave, the rest comes from the master.

4.1 Get the digital Values

ADDR default = 0x40

First byte is: (ADDR << 1) + 1 for Read
(ADDR << 1) + 0 for Write

1. Request Measurement (2 bytes from Master)

ADDR | W	0xAC

2. Wait >4ms or wait for EOC=1 (goes up to VDD) or check the “Busy?” flag [5] in the status byte (only one byte reading needed).

3. Read Measurement (1 byte from Master, 5 bytes from Slave)

ADDR | R	<u>STATUS</u>	<u>P MSB</u>	<u>P LSB</u>	<u>T MSB</u>	<u>T LSB</u>

Getting only the pressure information; it is possible to read out only 3 bytes from the slave.

4.2 Interpretation of the digital Values

The scaling of the pressure and the temperature is a simple straight line function defined by two touples (points). This leads to the following linear equations.

P [u16]

16384	$P_{@16384}$ resp. **P_min**, e.g. –1 bar PR
49152	$P_{@49152}$ resp. **P_max**, e.g. 30 bar PR

The pressure range of the transmitter is stored in its memory and/or written on the associating papers.

P [bar] = (P [u16] – 16384) x ($P_{@49152}$ – $P_{@16384}$) / 32768 + $P_{@16384}$

The output range is ¼ to ¾ of the 16 bit output word. This way a little over- and under-pressure is measurable and the exceeding resolution of more then 30’000 point guarantee a very high resolution of 10’000 points even for the next lower standard pressure range.

T [u16]

384	**-50°C**
64384	**150°C**

The scaling goes from –50 to 150°C but the working temperature range of the transmitter is at maximum -40..110°C (depending on the order; 0..50°C and –10..80°C are the standard temperature ranges).

T[°C] = (floor(T[u16] / 16) – 24) x 0.05°C – 50°C

= (T[u16] >> 4) – 24) x 0.05°C – 50°C

Reduce the 16 bits of the temperature information first to 12bit; the last 4 bits are anyway noise floor. This way a resolution of 1/20°C is still given.

Examples

Read Measurement (after a request by 0x80 | 0xAC and waiting for >4ms)

0x81	0x40	0x4E	0x20	0x5D	0xD1
ADDR=0x40 / Read	STATUS	Pressure		Temperature	

STATUS: 0x40 means no error, just powered

Pressure: 0x4E20 = 20 000_{dec}

for a "PR-7LD / -1..10bar" transmitter: p[bar] = (*20 000* – 16384) x (**10bar** – (**-1bar**)) / 32768 + (**-1bar**)

= 0.213867 bar

for a "PA-4LD / 30bar" transmitter: p[bar] = (*20 000* – 16384) x (**30bar** – **0bar**) / 32768 + **0bar**

p[bar] = (*20 000* – 16384) x **30bar** / 32768

= 3.31055 bar (4.31055 bar in relation to vacuum)

for a "PAA-9LD / 3bar" transmitter: p[bar] = (*20 000* – 16384) x (**3bar** – **0bar**) / 32768 + **0bar**

p[bar] = (*20 000* – 16384) x **3bar** / 32768

= 0.331055 bar (in relation to vacuum)

Temperature: 0x5DD1 = 24 017_{dec}, T[°C] = (*24 017* – 384) x 0.003125°C – 50°C

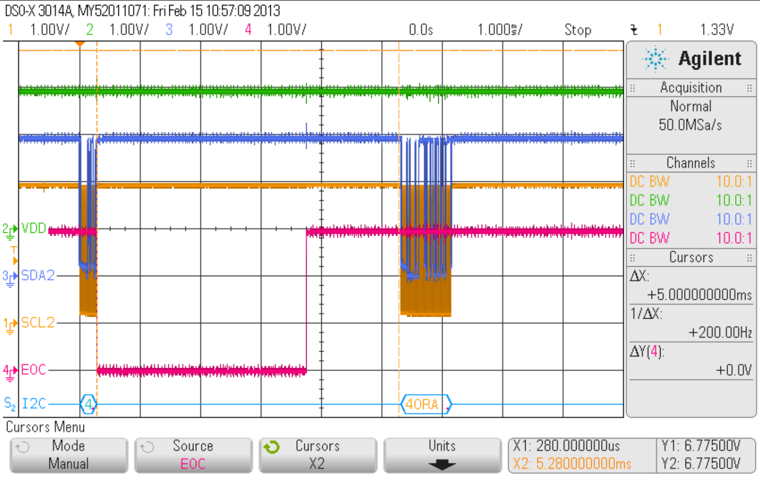
= 23.8531 °C (incl. noise)

Shift right by 4 : 24 017 / 16 = 1501 T[°C] = (*1501* – 24) x 0.05°C – 50°C

= 23.85 °C (without 4 Bit of noise)

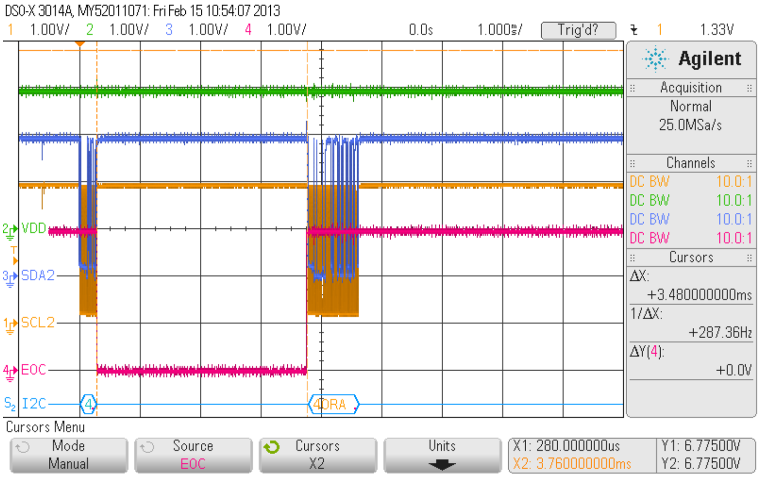
4.3 Variants to detect the End Of Conversion

Yellow: SCL, Blue: SDA, Red: EOC, Green: SUP, Bit Rate: 75kHz



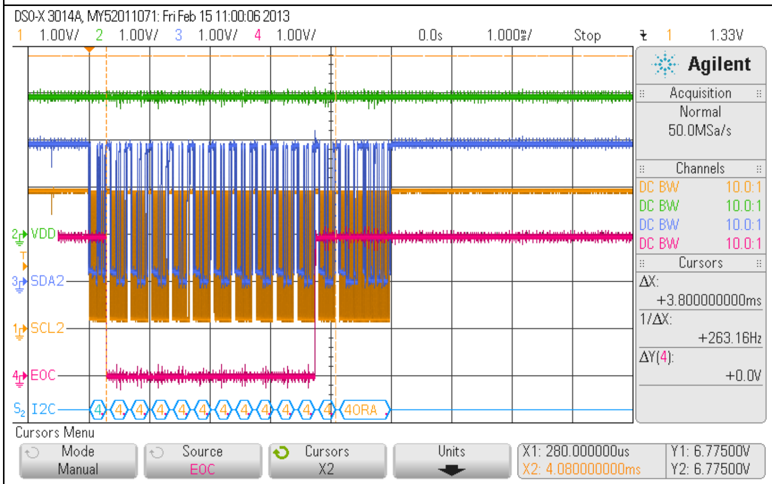
The simplest way to “detect” the end of a conversion (EOC) is to wait until the new data is definitely ready to read out. Being on the safe side; the conversion and the conditioning of the pressure and temperature value is completed after 4ms.

While the >4ms of waiting, the Master controller can be in sleep mode or doing some other tasks like requesting other pressure transmitters on the bus to make a new conversion.



The handshake-solution, done by the additional EOC wire, is very elegant and is suitable to save time and power. The Master controller can be in sleep mode and will be awoken by an external interrupt on the positive slope of the EOC pin. Polling the level of the EOC wire is also possible.

For this solution an additional wire per transmitter is needed. It is not possible to connect all the EOC wires commonly like SCL and SDA of the bus system.



To save time without the additional EOC wire is possible by reading out the status of the pressure transmitter. There is no request needed, just a simple readout command for the first byte that contains the “Busy?” flag.

Bit	7	6	5	4	3	2	1	0
Meaning	0	1	Busy?	Mode		Memory error?	Don't care	Don't care

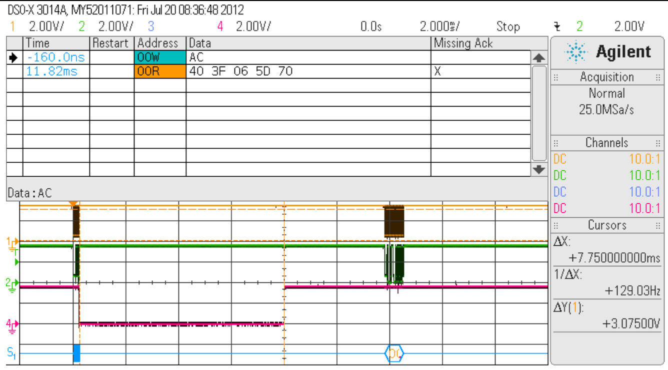
Bit 6 and bit 5 (“Busy?”) will be „1“ during the conversion. At the end of the conversion bit 5 changes to “0”. Then the new data is ready to read out by additional Clocks for the pressure and temperature bytes or a new readout command to shift out the whole 5 byte data frame.

This variant effects the highest power consumption because the Master controller is nonstop busy and also the pull-up resistors are energized more often.

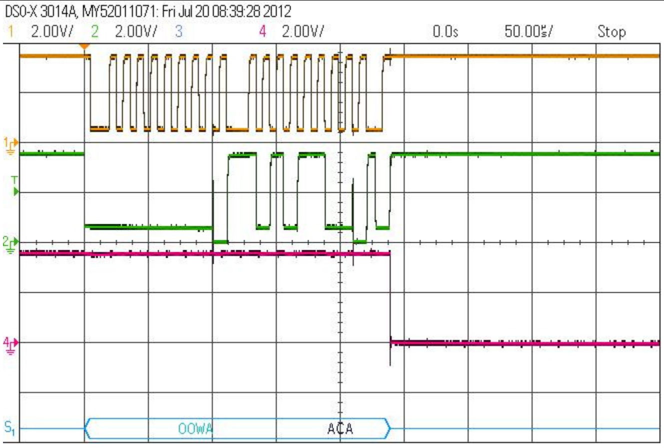
4.4 Voltage-Time-Diagrams

The following measurements are taken with 1kOhm pull-up resistors. In series to the master controller SCL and SDA line are 100E resistors to get a visual difference between an active LOW level from the master and from the slave. The slave is able to pull SDA hard to ground, a LOW level from the master goes only down to 10% of the supply voltage. The address of the slave is 0x00 and the bit rate 100kHz.

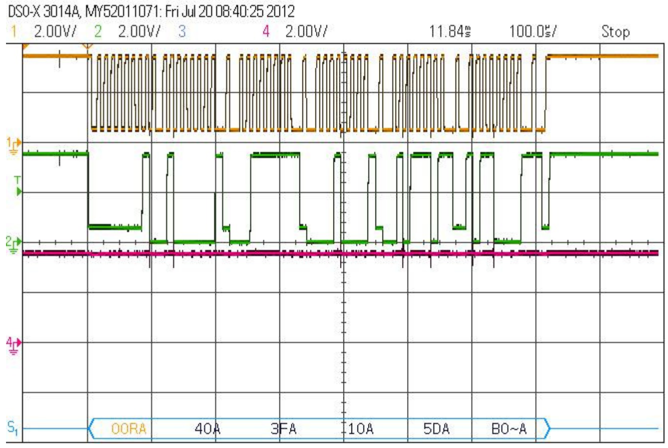
Yellow: SCL, Green: SDA, Red: EOC, Blue: I²C analyser



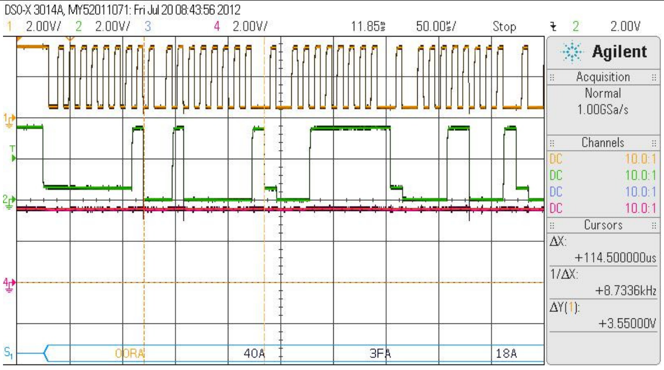
The EOC line is low for 7.75ms. The newest datasheet guarantees a conversion time below 4ms. To reach sample rates over 200 SPS it is a must to work with a high bit rate and to check the EOC line or to poll the STATUS byte.



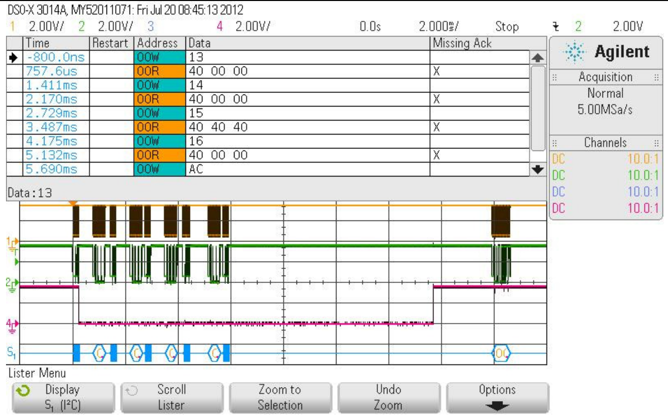
Nice to see: The ACK from the slave follows immediately to the negative edge of the 8th clock impulse (two times visible).



No acknowledge (NACK) from the master after reading out the 5th data byte. The "Missing Ack" that is recorded in the tables is not a mistake, it's a must.



More detailed view of the readout frame: EOC is back to 3.6V. The slave ACK occurs as normal immediately after the neg. edge of the 8th clock impulse. The ACK from the master occurs with a little delay but this is allowed because the master generates the 9th click impulse by itself at the right time.



On the left side are 4 read cycles on the memory visible before the request 0xAC command occurs. In the memory cells 0x13 .. 0x16 is the scaling of the pressure output stored.

0x13 and 0x14 contain Pmin, here 0bar

0x15 and 0x16 contain Pmax, here 3bar

The table does not show the last action on the bus. 4ms after the 0xAC command follows the readout of the 5 data bytes including STATUS, pressure and temperature.

5 Optional further Commands

It is possible to read out a unique product code, the date of calibration and the scaling of the transmitter.

5.1 Memory-Map of User Information

16 bit memory cells

MTP Address	Description	Definition	Remarks
0x00	Cust_ID0	Equipment# [0..63] Bit10..15 | Place# [0…1023] Bit0..9	for DB access
0x01	Cust_ID1	File# Bit0..15	for DB access
0x11	Not assigned	File# Bit16..31	presently AUX
0x12	Scaling0	Year [0..31]+2010 Bit11..15 | Month [0..15] Bit7..10| Day [0..31] Bit2..6| P-Mode[0..3] Bit0..1	Y:5bit|M:4bit|D:5bit|P:2bit
0x13	Scaling1	P_16384 [f32 (IEEE 754, single) MSWord]	Pmin [bar] als 32bit float
0x14	Scaling2	P_16384 [f32 (IEEE 754, single) LSWord]	
0x15	Scaling3	P_49152 [f32 (IEEE 754, single) MSWord]	Pmax [bar] als 32bit float
0x16	Scaling4	P_49152 [f32 (IEEE 754, single) LSWord]	

IEEE 754: single respectively float from “single-precision binary floating-point format”

P-Mode[0..3]: 0=PR, 1=PA, 2=PAA, 3=AUX

The combination of Cust_ID0 and Cust_ID1 makes a 32bit code to recover calibration data at KELLER or to have a recognition feature for data bases on the customer side.

The scaling e.g. “PR –1..10bar" is stored in Scaling0 to Scaling4 but could also be read on the associating papers. The date of calibration is an additional information that finds also place in Scaling0.

Read Memory Content:

ADDR default = 0x40

First byte is: (ADDR << 1) + 1 for Read
(ADDR << 1) + 0 for Write

1. Request Measurement (2 bytes from Master)

ADDR | W	MTP Address (0x00..0x16)

2. Wait for 0.5ms or check the “Busy?” flag

3. Read Measurement (1 byte from Master, 3 bytes from Slave)

ADDR | R	STATUS	Mem MSB	Mem LSB

4. Interpretation

In the two LSBs of cell 0x12 is the pressure mode (sealed or vented gauge and zero definition) stored.

The content of cell 0x13 and 0x14 is a floating-point value that indicates the pressure in [bar] for the lower output value, 16384.

The content of cell 0x15 and 0x16 is a floating-point value that indicates the pressure in [bar] for the higher output value, 49152.

Example

MTP Address	**Description**	**Value**	**Decoding**
0x00	Cust_ID0	0x0415	0b000001|0000010101: 1|21 => Equipment#: 1, Place#: 21
0x01	Cust_ID1	0x0111	0b0000000100010001: 273 => File#: 273
0x11	Not assigned	0x0000	Not assigned
0x12	Scaling0	0x1574	0b00010|1010|11101|00: 2|10|29|0 => Date: 29.10.2012, Mode: PR
0x13	Scaling1	0xBF80	binary-to-float(0xBF800000) = -1.0E0 - 1 bar
0x14	Scaling2	0x0000	
0x15	Scaling3	0x4120	binary-to-float (0x41200000) = 1.0E1 + 10 bar
0x16	Scaling4	0x0000	

Unique Product Code: Cust_ID1 x 65536 + Cust_ID0 = 0x01110415 = 17892373

5.2 Recommended Slave Addresses

If you want to combine more than one pressure transmitter on the same I^2C bus, the slave addresses have to be unique. For this purpose the memory content of -for example- a second transmitter has to be overwritten. It is not possible to erase the content to make any possible change because the memory is based on a “one time programmable” technology, so it is only possible to add some “1”s by burning additional bit-cells. After adding 6 “1”s to the 7 bit slave address register, there is a further possibility to make changes: clearing the whole memory content by incrementation of the page counter. That gives you in minimum a second chance to choose a slave address absolutely independent from the tries before.

The conclusion is that it is not possible to change the slave address unlimited times. So it is recommended to plan the whole bus system and program the bus addresses once or in case of something unpredictable a second time.

To have more than one possibility per memory page to change the slave address, we recommend the following set off addresses.

Shot	Description	Slave-ADDR
0	1st Transmitter, default	0x40
1	2nd Transmitter	0x41
2	3rd Transmitter	0x43
3	4th Transmitter	0x47
4	5th Transmitter	0x4F
5	6th Transmitter	0x5F
(6)	(7th Transmitter)	(0x7F)

With the mentioned addresses it is possible to make for example a 3rd transmitter on the bus to a 4th.

The „I^2C committee” does not recommend to use addresses between 0x78 and 0x7F, so the 6th try is possible but not favoured.

The addresses 0x00 to 0x07 are also reserved and 0x00 is the „General call address“.

If you change the slave address and don’t use a new memory page, the checksum can not be updated. The STATUS byte is then no longer 0x40 (only bit 6 is set), it becomes 0x44 (“Memory error?” appears) but that has no effect to the functionality of the transmitter, it just makes it impossible to detect a memory error.

5.3 Changing the Slave Address

We don't recommend to change the slave address with the following recipe and it explains anyway only how to write additional "1" to the current memory page. A free choice of the slave address is much more difficult and should be done with our USB-to-I2C data converter in combination with the appending PC application.

1. Turn off the power supply of the transmitter
2. Set the transmitter into Command-Mode by sending 0xA9 as first command:
   | (ADDR <<1)+0 | 0xA9 |
3. Optionally read the actual Slave-Address from memory cell 0x02 (also possible in Normal-Mode) to get the needed information to add only one single "1" (to erase already burned "1s" is not possible in a OTP):
   | (ADDR<<1)+0 | 0x02 |, wait 0.5ms, | (ADDR<<1)+1 | Status | HighByte | LowByte |
   The Slave-ADDR is in the 7 LSBs. All other 9 bits should be "0".
   In the Status-Byte appears an additional "1" to indicate the Command-Mode: Bit3=1; Bit4=0;
4. Set new Slave-Address in memory cell 0x02 with the write-command-offset of 0x40:
   | (ADDR<<1)+0 | 0x42 | HighByte | LowByte |
   The Slave-ADDR is in the 7 LSBs. All other 9 bits should be "0".
5. Optionally check/verify the new memory content by repeating step 3
6. Update the Slave-Address in the RAM in the transmitter by switching the power off and on.
   Sending the Start_NOM command 0xA8 does not update the RAM.

Communicate from this moment on with the new Slave-Address.
Note: Because it is not possible to update the CheckSum over the whole memory content, the "Memory error?" flag in the Status-Byte is from now set: Bit2=1;

6 Appendix

6.1 Change Settings by Interface Converter

6.1.1 USB-to-I2C Dongle

Coming in March 2013

6.1.2 PC Application to change the Slave Address

Coming in March 2013

6.2 Code Examples

Still under construction

6.2.1 Read Measurement: Header-File

```
/////////////////////////////////////////////////////////////////////////////
// constants
#define SDA_OUT     TRISDbits.TRISD5    // RD5 is SDA (without MSSP)
#define SDA_OD      LATDbits.LATD5
#define SDA_IN      PORTDbits.RD5
#define SCL_OUT     TRISDbits.TRISD6    // RD6 is SCL (without MSSP)
#define SCL_OD      LATDbits.LATD6


#define cZI_Pmin    0                   // fix coded or read out from the userMEM
#define cZI_Pmax    30                  // fix coded or read out from the userMEM

/////////////////////////////////////////////////////////////////////////////
// global variables
#ifndef __C_ZI_ZSSC_I2C__
extern
#endif
_F32 ZI_pressure;   // Variable for pressure value in [bar] as single (IEEE 754)

#ifndef __C_ZI_ZSSC_I2C__
extern
#endif
_F32 ZI_temperature;// Variable for temperature value in [°C] as single (IEEE 754)

#ifndef __C_ZI_ZSSC_I2C__
extern
#endif
_U8 ZI_status;      // Variable for 8 bit status

#ifndef __C_ZI_ZSSC_I2C__
extern
#endif
_U8 ZSSCget[5];     // Array to receive data frame


/////////////////////////////////////////////////////////////////////////////
// prototypes global functions
_U8 get_PnT_GPIO(_U8);
_U8 get_PnT_MSSP(_U8);
```

6.2.2 Read Measurement: C-File

```
////////////////////////////////////////////////////////////////////////////
// global functions

_U8 get_PnT_GPIO(_U8 ADDR){
    _U8 ZSSCerror=0;
    _F32 Pmin, Pmax;
    union {
        _F32 floatingpoint;
        _U32 twotimesU16;
    } cast;

    ////// init IOs ( better once before while(1) ) //////
    SDA_OD=0;    // LOW if output active: Open Drain
    SCL_OD=0;    // LOW if output active: Open Drain

    SDA_OUT=1;  // release SDA => pull-up resistor makes HIGH level
    SCL_OUT=1;  // release SCL => pull-up resistor makes HIGH level

    ////// read the scaling //////
    I2C_write_1Byte(ADDR,0x13);
    Delay10TCYx(125);                    // 0.4us x 10 x 125 = 0.5ms
    I2C_read_xByte(ADDR,3);
    cast.twotimesU16 = (((_U32)(ZSSCget[1]))<<24) + (((_U32)(ZSSCget[2]))<<16);
    I2C_write_1Byte(ADDR,0x14);
    Delay10TCYx(125);                    // 0.4us x 10 x 125 = 0.5ms
    I2C_read_xByte(ADDR,3);
    cast.twotimesU16 += (((_U32)(ZSSCget[1]))<<8) +  ((_U32)(ZSSCget[2]));
    Pmin= cast.floatingpoint;

    I2C_write_1Byte(ADDR,0x15);
    Delay10TCYx(125);                    // 0.4us x 10 x 125 = 0.5ms
    I2C_read_xByte(ADDR,3);
    cast.twotimesU16 = (((_U32)(ZSSCget[1]))<<24) + (((_U32)(ZSSCget[2]))<<16);
    I2C_write_1Byte(ADDR,0x16);
    Delay10TCYx(125);                    // 0.4us x 10 x 125 = 0.5ms
    I2C_read_xByte(ADDR,3);
    cast.twotimesU16 += (((_U32)(ZSSCget[1]))<<8) + ((_U32)(ZSSCget[2]));
    Pmax= cast.floatingpoint;

    ////// request new conversion //////
    if(I2C_write_1Byte(ADDR,0xAC)){return 0x91;}

    ////// wait for new conversion result //////
    Delay100TCYx(250);                   // 0.4us x 100 x 250 = 10ms

    ////// read the results out //////
    if(I2C_read_xByte(ADDR,5)){return 0x91;}

    ////// interpret integer values //////
    ZI_status      =                                          ZSSCget[0];   //  [U8]
    ZI_pressure    = (_F32)( (((_U16)(ZSSCget[1]))<<8) + (_U16)(ZSSCget[2]) ); // p[U16]
    ZI_temperature = (_F32)( (((_U16)(ZSSCget[3]))<<8) + (_U16)(ZSSCget[4]) ); // T[U16]

    ZI_pressure    = (ZI_pressure-16384)*(Pmax-Pmin)/32768+Pmin;                // p[bar]
    ZI_temperature = (((((_U16)ZI_temperature)>>4)-24)*0.05)-50;               // T[°C]

    return ZSSCerror;
} // end of _U8 get_PnT_GPIO(_U8 ADDR)
```

6.3 Application Notes

Coming soon

6.4 Protocol Changes

- **Document Version 2.0**, 7. December 2012:
  Many chapters with basic information to the I²C interface added, the Version 1.0 was a preliminary version with only KELLER specific descriptions. Changed the default “Slave Address” form 0x00 to 0x40.
- **Document Version 2.1**, 15. February 2013:
  Changed the “Conversion Time” from 10ms to 4ms. New Graphics to show the faster sampling and the lower (shorter) current consumption.

6.5 Firmware Versions

The Firmware is fixed in the Silicon (ROM-Version) and can’t be changed by KELLER. A few settings and the content definition of the “Customer-Memory” are the only free parameters but there are no planes to change anything.

Version Year.Week	Date of Production	Major Changements
36CI1CH 29.12	2012…	Base Version with temperature PGA settings for –40..110°C

6.6 Support

We are pleased to offer you support in implementing the protocol. Use our free PC-software XXXXX in combination with the USB-to-I2C-Dongle for a first communication with the transmitter and for the configuration of non-default “Slave Addresses”. Please visit our website http://www.keller-druck.com to check updates and further application notes.

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